

e. Remarks

Amendments to Drawings

Applicants request approval of amended Figure 7 as shown on the Replacement Sheet. Amended Figure 7 corrects a formal drawing mailed April 11, 2002 so that that drawing conforms to originally filed Figure 7. The amendment of the figure mailed April 11, 2001 is illustrated on an attached Annotated Marked-up Drawing.

New Dependent Claims

New claims 19 – 21 are, e.g., supported at page 7, lines 8 – 9 and 23 – 25.

Cited References

With respect to the request at page 2, paragraph 1 of the Office Action, Applicants note that 37 C.F.R. § 1.56 describes the Duty to Disclose information.

Rejections under 35 U.S.C. § 112

Claim 13 has been amended to replace “the photoresist has” by “the medium is a photoresist having”. The recitation of “the medium” in claim 13 has antecedent basis in base claim 11.

In claim 15, “the providing a medium” refers to the step of “providing a medium” in base claim 14. Thus, “the providing a medium” has antecedent basis in claim 14 and is not vague or indefinite.

Claim 10 recites that the pattern is periodic and non-constant. Many patterns have such properties, e.g., $\cos(2\pi nx)$ and $\sin(2\pi nx)$ are periodic and non-constant in x where n is any positive integer. In light of many such examples, claim 10 is neither vague nor indefinite

Rejections under 35 U.S.C. § 102(a)

At page 3, the Office Action rejects claims 1 – 10, 14, 16, and 18 as anticipated by the article entitled “Photonic Crystals Made by Holographic Lithography” by A.J. Turberfield, MRS Bulletin (August 2001) pages 632 – 636. Herein, referred to as “Turberfield”.

Independent claim 1 recites that the exposure is “while the medium is maintained in a condition that inhibits or prevents ... refractive index changes...”. Claim 14 recites

“the exposure being at a temperature that inhibits or prevents ... refractive index changes...”. In contrast, Turberfield does not teach maintaining his photo-sensitive medium in a condition that inhibits or prevents refractive index changes. Instead, Turberfield states that:

The film is exposed to the interference pattern generated by four beams split from a single pulse The duration of the laser pulse (6 ns) is short ..., so the interference pattern is unperturbed by photoinduced changes in the refractive index of the precursor ...

Turberfield, page 633, col. 3, lines 36 – 44 (underlining added).

Rather than teaching maintaining the photo-sensitive film in a condition that inhibits or prevents refractive index changes, Turberfield keeps the exposure short to limit undesired effects of such changes during the exposure. Furthermore, the above citation from Turberfield evidences that it is not inherent in his method to maintain the medium so as to inhibit or prevent refractive index changes. Turberfield does not explicitly or inherently teach maintaining the photo-sensitive medium to inhibit such refractive index changes.

The Office Action further states that:

[T]he polymerization does not occur until the post-exposure is held to meet the requirement that the exposure take place at a temperature at which refractive index changes do not occur.

Office Action, page 3, lines 17 – 19.

In response, Applicants note that an absence of polymerization reactions in a photo-sensitive medium does not necessarily imply that refractive index changing reactions are inhibited or prevented. For example, the pending specification states:

The photo-chemical reactions generate products that are able to stimulate other chemical reactions that change the index of the starting medium. Exemplary of these other chemical reactions are polymerization of the oligomers, deprotection of units of polymers, and crosslinking of functional groups of polymers.

Specification, page 4, lines 5 – 9 (underlining added).

Polymerization is not the only candidate chemical reaction of photo-sensitive media for producing refractive index change. Thus, even if Turberfield maintained his photoresists during exposure under conditions that inhibited polymerization, that would not imply that refractive index changes were also inhibited or prevented. Also, in light of Turberfield's own statements at page 633, 3rd column, lines 36 – 44 (see above), his article does not suggest that his conditions of his exposure inhibited or prevented the production of refractive index changes in his photo-sensitive media.

For the above reasons, Turberfield does not teach all limitations of claim 1 or claim 14 either explicitly or inherently.

Claims 2 – 10, 16, and 18 - 20 are novel, at least, by their dependence on claim 1 or claim 14.

Claim 5 also recites that “the medium includes a concentration of molecules that are able to neutralize photo-chemical reaction products produced by the exposing, ...” The Office Action does not cite a teaching for this feature from Turberfield. The lack of such a teaching provides an additional reason why claim 5 is novel over Turberfield.

Rejections under 35 U.S.C. § 102(b)

At page 4, the Office Action rejects claims 1 – 10, 14, 16, and 18 as anticipated by the article entitled “Fabrication of photonic crystals for the visible spectrum by holographic lithography”, by Campbell et al, Nature vol. 404, pages 53 – 56 (March 2000) (Herein, referred to as “Campbell”).

Claim 1 recites “exposing a photo-sensitive ... while the medium is maintained in a condition that inhibits or prevents ... refractive index changes...”. Claim 14 recites “the exposure being done at a temperature that inhibits or prevents ... refractive index changes.” In contrast, Campbell does not teach maintaining the medium in a condition that inhibits or prevents refractive index changes. Instead, Campbell states that:

The duration of the laser pulse (6 ns) is short compared to the time scales of physical and chemical processes induced by the exposure, so the interference pattern is unperturbed by photoinduced changes in the refractive index of the precursor ...

Campbell, page 54, col. 1, lines 26 – 30.

Rather than suggesting that his photo-sensitive medium is maintained during the exposure to inhibit or prevent refractive index changes, Campbell keeps the exposure short to reduce undesired perturbations by such changes. Furthermore, the above citation from Campbell evidences that it is not inherent in his method to maintain the medium so as to inhibit or prevent refractive index changes. Campbell does not explicitly or inherently teach maintaining the photo-sensitive medium to inhibit or prevent such refractive index changes.

The Office Action also states that:

The statement that the polymerization does not occur until the post-exposure bake is held to meet the requirement that the exposure take place at a temperature at which refractive index changes do not occur.

Office Action, page 4, lines 13 – 15.

In response, Applicants note that an absence of polymerization reactions in a photo-sensitive medium does not necessarily imply that refractive index changing reactions are inhibited or prevented. For example, the pending specification states:

The photo-chemical reactions generate products that are able to stimulate other chemical reactions that change the index of the starting medium. Exemplary of these other chemical reactions are polymerization of the oligomers, deprotection of units of polymers, and crosslinking of functional groups of polymers.

Specification, page 4, lines 5 – 11 (underlining added).

Polymerization is not the only candidate for a chemical reaction in a photo-sensitive medium that may produce a refractive index change. Even if Campbell maintained his photoresist under conditions that inhibited polymerization, that would not of itself imply that he maintained his photoresist to inhibit or prevent producing refractive index changes therein. Also, in light of Campbell's own statements at page 54, col. 1, lines 26 – 30, his article makes no suggestion that his exposure conditions inhibit or prevent refractive index changes in his photo-sensitive media.

For the above reasons, Campbell does not explicitly or inherently teach all limitations of claim 1 or claim 14.

Claims 2 – 10, 16, and 18 - 20 are novel over Campbell, at least, by their dependence on claim 1 or claim 14.

Also, claim 5 recites that the “medium includes a concentration of molecules that are able to neutralize photo-chemical reaction products produced by the exposing.” The Office Action does not cite any teaching from Campbell for this feature. The lack of such a teaching provides an independent reason why claim 5 is novel over Campbell.

Rejections under 35 U.S.C. § 103(a)

At pages 4 - 5, the Office Action rejects claims 1 – 10, 14, and 16 – 18 as obvious over a combination of either Campbell or Turberfield with EPO Patent Publication EP 408227 (Herein, referred to as Liang).

The Office Action, does not cite Liang as teaching any elements of independent claims 1 or 14. Since the Office Action does not specifically cite Liang for features of claim 1 or claim 14, Applicants assume that the Office Action is citing Campbell or Turberfield to teach “maintaining the medium under conditions that inhibit or prevent refractive index changes” as in claims 1 and 14. As already discussed above, neither Campbell nor Turberfield teaches such a limitation. Thus, the prima facie case of obviousness over this combination of three references is defective.

Claims 2 – 10, 16, and 18 – 20 are non-obvious over the cited combination of three references, at least, by their dependence on claim 1 or claim 14.

Rejections under 35 U.S.C. § 103(a)

At page 5, the Office Action rejects independent claims 1 – 18 as obvious over a combination of either Campbell or Turberfield with Liang and U.S. Patent 6,063,989 (Herein, referred to as Endo).

Claims 1 – 10 and 14 - 20

The Office Action does not cite Liang or Endo for teaching limitations of independent claim 1 or 14. Thus, Applicants assume that the Office Action is citing Campbell or Turberfield to teach maintaining the photo-sensitive medium to inhibit or prevent refractive index changes as in claims 1 and 14. As discussed above, neither Campbell nor Turberfield teaches such a limitation. For this reason, the prima facie case of obviousness over the combination of these four references is defective with respect to independent claims 1 and 14 and also is defective with respect to dependent claims 2 – 10 and 15 – 20.

Claims 11 – 13 and 21

The Office Action states that:

Endo et al. '898 teach the addition of amines to epoxy resins to facilitate their dissolution or dispersion in solvents. Useful neutralizing agents include triethylamine. (57/50-58/3)
Office Action, page 5, line 19 – 20.

Endo discloses that his neutralizing agents are useful for obtaining water-soluble curable compositions. See Endo, column 28, lines 15 – 28. Endo also states that:

In a water-based coating, water is employed as a medium, ... For example, as the water-based coating, there has been known a coating in which there is neutralized a resin composition containing a polycarboxylic acid resin
Endo, column 50, line 61, to col. 51, line 1.

Also, the section cited in the Office Action, is entitled “THEREMOSETTING TYPE WATER-BASED COATING COMPOSITION”. Endo, col. 57, lines 8 – 9 (underlining added).

Endo’s teachings with respect to dispersing epoxy resins to form water-based media do not motivate using his neutralizers in the photo-sensitive media of Campbell or Turberfield. For example, neither Campbell nor Turberfield discloses that a photo-sensitive medium is water-based. Indeed, Campbell specifically states that his resin is dissolved in the solvent γ -butyrolactone, which is not water. Campbell, page 54, col. 1, lines 11 – 12. Furthermore, neither Turberfield nor Campbell discloses a problem with dissolving or dispersing their epoxies in their solvents. For these reasons, the Office Action has not provided a sufficient motivation to modify Campbell and Turberfield according to the cited teachings of Endo. The combination of the Office Action is based on pure hindsight.

Similarly, the Office Action states:

In addition to the basis provided above it would have been obvious to modify the invention of **either** Campbell, ... **or** Turberfield, ... by adding an amine, such as triethyl amine to facilitate the dissolution/dispersion of the epoxy resin as taught by Endo....

Office Action, page 5, line 21, to page 6, line 4.

The Office Action does not provide a prior art motivation to modify Campbell or Turberfield in the manner suggested in the above citation. For example, the Office Action cites no teaching from either Campbell or Turberfield to show that the prior art had recognized a problem with dissolving Campbell’s or Turberfield’s epoxies in their solvents. The combination of the Office Action is again based on pure hindsight.

For the above reasons, a proper prima facie case of obviousness has not been established for any of claims 1 - 21.

Obviousness Double Patenting Rejection

At page 6, the Office Action provisionally rejects claims 1 – 18 under the judicially created doctrine of double patenting over claims 1, 6, and 7 of co-pending U.S. Application No. 10/321,027 (Herein, the '027 application.).

Claims 1, 6, and 7 of the '027 application do not disclose “maintaining the medium during the exposure to inhibit or prevent refractive index changes as in pending claims 1 and 14. For that reason, pending independent claims 1 and 14 and dependent claims 2 – 10 and 15 – 20 are non-obvious over claims 1, 6, and 7 of the '027 application.

Claims 1, 6, and 7 of the '027 application do not disclose “neutralizer molecules dispersed in the medium” as recited in pending claim 11. For that reason, pending independent claim 11 and dependent claims 12 – 13 and 21 are non-obvious over claims 1, 6, and 7 of the '027 application.

For the above reasons, Applicants request that the provisional obviousness-type, double-patenting rejections over the '027 application be withdrawn.

Conclusion

Applicants respectfully request allowance of claims 1 – 21 as presently pending.

In the event of any non-payment or improper payment of a required fee, the Commissioner is authorized to charge or to credit **Lucent Technologies Deposit Account No. 12-2325** to correct the error.

Respectfully,



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Annotated Marked-up Drawing

5/7

FIG. 7

